PATENT CLAIMS

1.   An electro-optical voltage sensor for measurement
of an electrical voltage V, the voltage V being present
5 between two electrodes (3, 4) and generating an
electric field, the electrodes (3, 4) being arranged in
a manner spaced apart from one another, and an electro-
optically active medium (1) being arranged between the
electrodes (3, 4), into which medium light (5) can be
10 radiated, it being possible to influence the state of
polarization of said light in the electro-optically
active medium (1) by means of the electric field and to
detect it after emergence from the electro-optically
active medium (1), it being possible to determine the
15 voltage V from the detected state of polarization,
characterized in that
a distance medium (2) is arranged between the two
electrodes (3, 4), the electro-optically active medium
(1) being arranged with an effective thickness d_1 and
20 the distance medium (2) with an effective thickness d_2
between the two electrodes (3, 4) and the effective
thicknesses d_1, d_2 being chosen in such a way that
temperature influences on the detected state of
polarization of the light (5) are essentially
25 compensated for.

2.   The voltage sensor as claimed in claim 1,
characterized in that the effective thickness d_2 of the
distance medium (2) and the effective thickness d_1 of
30 the electro-optically active medium (1) are chosen in
such a way that the influences of the temperature
dependences of temperature-dependent material constants
of the distance medium (2) and of the electro-optically
active medium (1) on the detected state of polarization
35 of the light (5) are essentially compensated for.

3.   The voltage sensor as claimed in claim 2, characterized in that the temperature-dependent material constants are
-       critical electro-optical coefficients (k),
5   -   dielectric constants (ε) and
-       thermal expansion coefficients (α).

4.   The voltage sensor as claimed in claim 1 or 2, characterized in that the effective thickness d_2 of the
10   distance medium (2) and the effective thickness d_1 of the electro-optically active medium (1) are chosen in such a way that the influences of the temperature dependences of the dielectric constant ε_1 of the electro-optically active medium (1) of the dielectric
15   constant ε_2 of the distance medium (2) and,
-       if the distance medium (2) is not electro-optically active or the light (5) does not radiate through the distance medium (2): of the critical electro-optical coefficient k_1 of the electro-
20   optically active medium (1), and
-       if both the electro-optically active medium (1) and the distance medium (2) are electro-optically active and light (5) is radiated through them: of the critical electro-optical coefficient k_1 of the
25   electro-optically active medium (1) and of the critical electro-optical coefficient k_2 of the distance medium (2),
on the detected state of polarization of the light (5) essentially cancel one another out.
30

5.   The voltage sensor as claimed in claim 4, characterized in that the following holds true:
$$d_1 \cdot [(\partial k_1 / \partial T) \cdot E_1 + k_1 \cdot (\partial E_1 / \partial T)] + d_2 \cdot [(\partial k_2 / \partial T) \cdot E_2 + k_2 \cdot (\partial E_2 / \partial T)] \approx 0$$
if the light (5) also radiates through the distance
35   medium (2), and:
$$(\partial k_1 / \partial T) \cdot E_1 + k_1 \cdot (\partial E_1 / \partial T) \approx 0$$

if the light (5) does not radiate through the distance
medium (2) or the latter is not electro-optically
active;

where E_1 is the electric field strength in the electro-
optically active medium (1) and E_2 is the electric field
strength in the distance medium (1),

and in particular where the aforementioned electric
field strengths are approximated as

$$E_1 \approx \varepsilon_2 \cdot V / (\varepsilon_2 \cdot d_1 + \varepsilon_1 \cdot d_2) \text{ and}$$
$$E_2 \approx \varepsilon_1 \cdot V / (\varepsilon_2 \cdot d_1 + \varepsilon_1 \cdot d_2)$$

6.   The voltage sensor as claimed in one of the
preceding claims, characterized in that the distance
medium (2) is transparent and of a solid state of
aggregation, and in that the light radiates through
both the distance medium (2) and the electro-optically
active medium (1).

7.   The voltage sensor as claimed in one of the
preceding claims, characterized in that the distance
medium (2) has a vanishing critical electro-optical
coefficient k_2 and/or a vanishing temperature dependence
$\partial k_2 / \partial T$ of its critical electro-optical coefficient k_2,
and in particular has a negligible temperature
dependence $\partial \varepsilon_2 / \partial T$ of its dielectric constant ε_2.

8.   The voltage sensor as claimed in one of the
preceding claims, characterized in that a stack of N
elements of the electro-optically active medium (1) and
N+1 elements of the distance medium (2) is arranged
between the electrodes (3, 4), N being an integer where
$N \geq 1$, and an element of the electro-optically active
medium (1) in each case being arranged between two
adjacent elements of the distance medium (2), the first
and the last element in the stack being in contact with
a respective one of the two electrodes (3, 4) and, in
particular, each of the elements being essentially

cylindrical with essentially the same cylinder diameter.

9. The voltage sensor as claimed in claim 8, characterized in that the elements of the electro-optically active medium (1) have such an effective thickness and are arranged between the electrodes (3, 4) in such a way that a deviation between the voltage determined by means of the voltage sensor and the voltage V to be measured is minimal.

10. The voltage sensor as claimed in claim 8, characterized in that the elements of the electro-optically active medium (1) all have the same effective thickness $\delta_1 = d_1/N$, and in that either
(a) the elements of the distance medium (2) have an effective thickness $\delta_2 = d_2/N$, but the outer two elements of the distance medium (2) in the stack have an effective thickness $\delta_2' = d_2/(2 \cdot N)$, or in that
(b) the elements of the distance medium (2) have an effective thickness $\delta_2 = d_2/(N+1)$.

11. The voltage sensor as claimed in one of the preceding claims, characterized in that the electrodes (3, 4) together with the electro-optically active medium (1) and the distance medium (2) are cast in silicone (15).

12. The voltage sensor as claimed in one of the preceding claims, characterized in that the electrodes (3, 4) together with the electro-optically active medium (1) and the distance medium (2) are cast in silicone, the silicone in the region of the electrodes (3, 4), of the electro-optically active medium (1) and of the distance medium (2) being formed essentially in cylindrical or barrel-shaped fashion with a diameter which is between 1.1 and 6 times, in particular between

2 and 4 times, as large as a maximum radial extent of the electrodes (3, 4).

13. The voltage sensor as claimed in claim 11 or 12,
5 characterized in that the silicone (15) in the region of the electrodes (3, 4), of the electro-optically active medium (1) and of the distance medium (2), is formed essentially in cylindrical or barrel-shaped fashion, and the electrodes (3, 4) have electrically
10 conductive voltage feeds (3b, 4b), which are formed essentially in rod-type fashion and are likewise cast in silicone, the silicone (15) in the region of the voltage feeds (3b, 4b) being formed essentially in cylindrical fashion and having a smaller diameter than
15 in the region of the electrodes (3, 4), of the electro-optically active medium (1) and of the distance medium (2), and, in particular, in that the silicone has a shielding on the outside.

20 14. The voltage sensor as claimed in one of the preceding claims, characterized in that the electro-optically active medium (1) is crystalline BGO which is oriented with its [001] direction parallel to the direction of propagation of the light (5), in that the
25 direction of propagation of the light (5) essentially runs along the electric field generated by the voltage V, and in that the distance medium (2) is fused silica.

15. A method for measurement of an electrical voltage
30 V, the voltage V being present between two electrodes (3, 4) arranged in a manner spaced apart from one another and generating an electric field, light (5) being radiated into an electro-optically active medium (1) arranged between the electrodes (3, 4), a state of
35 polarization of the light (5) being influenced in the electro-optically active medium (1) by means of the electric field and the light being detected after emergence from the electro-optically active medium (1)

and the voltage V being determined from the detected
state of polarization,

characterized in that

a distance medium (2) is arranged between the two
5   electrodes (3, 4), an effective thickness d_2 of the
distance medium (2) and an effective thickness d_1 of the
electro-optically active medium (1) being chosen in
such a way that temperature influences on the detected
state of polarization of the light (5) are essentially
10   compensated for.